United States Patent [19]

Stevenson

[11] **4,176,597**

[45] **Dec. 4, 1979**

[54] **MANUAL COMPACTOR**

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[73] Assignee: **Nelson & Johnson Engineering,** Boulder, Colo.

[21] Appl. No.: **823,565**

[22] Filed: **Aug. 11, 1977**

[51] **Int. Cl.**[2] **B30B 1/20**

[52] **U.S. Cl.** **100/244;** 100/266; 100/274; 100/289

[58] **Field of Search** 100/244, 264, 289, 290, 100/266, 255, 274, 275, 276, 277

[56] **References Cited**

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Attorney, Agent, or Firm—O'Rourke & Harris

[57] **ABSTRACT**

A manual compactor having two handles each pivoted at one end for movement through adjacent arcs toward and away from each other, such reciprocating activation motion being translated into rotary motion in a single direction by means of ratchet and pawl arrangements about the pivot shaft of each handle, and thenceforth to rotary motion of opposing screws one each of which is driven by each handle, which in turn act through ball nut structures to forcibly draw together plates with force sufficient for compacting, the handles also having provisions for actuating push rod within the handles for the purpose of disengaging the pawls from the ratchets thereby allowing retraction through spring loading of the plates and repositioning of the apparatus for subsequent compacting.

8 Claims, 4 Drawing Figures

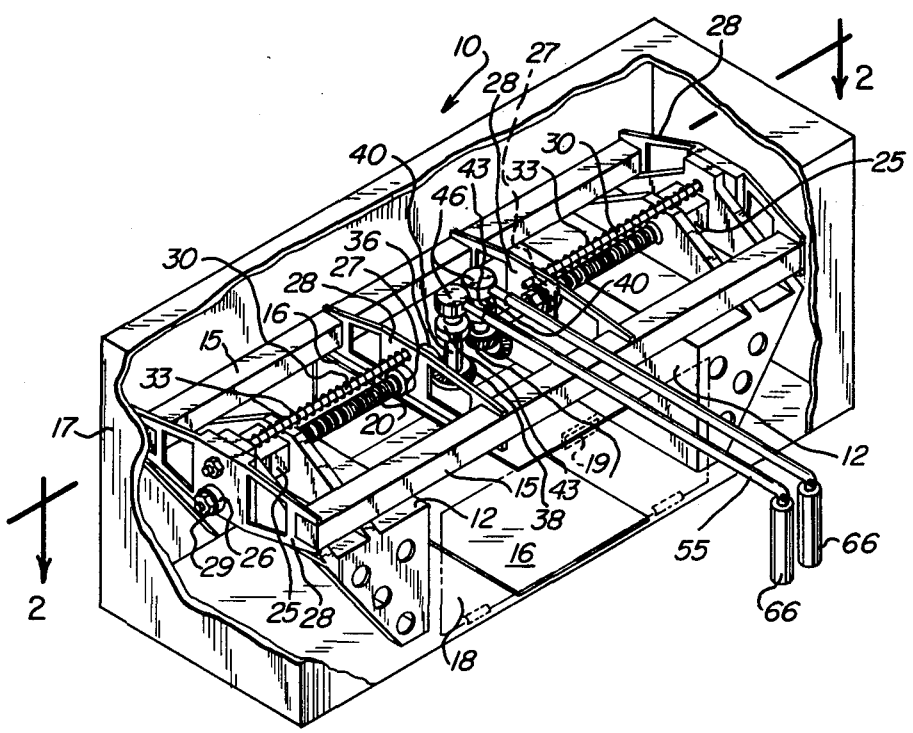

Fig-1

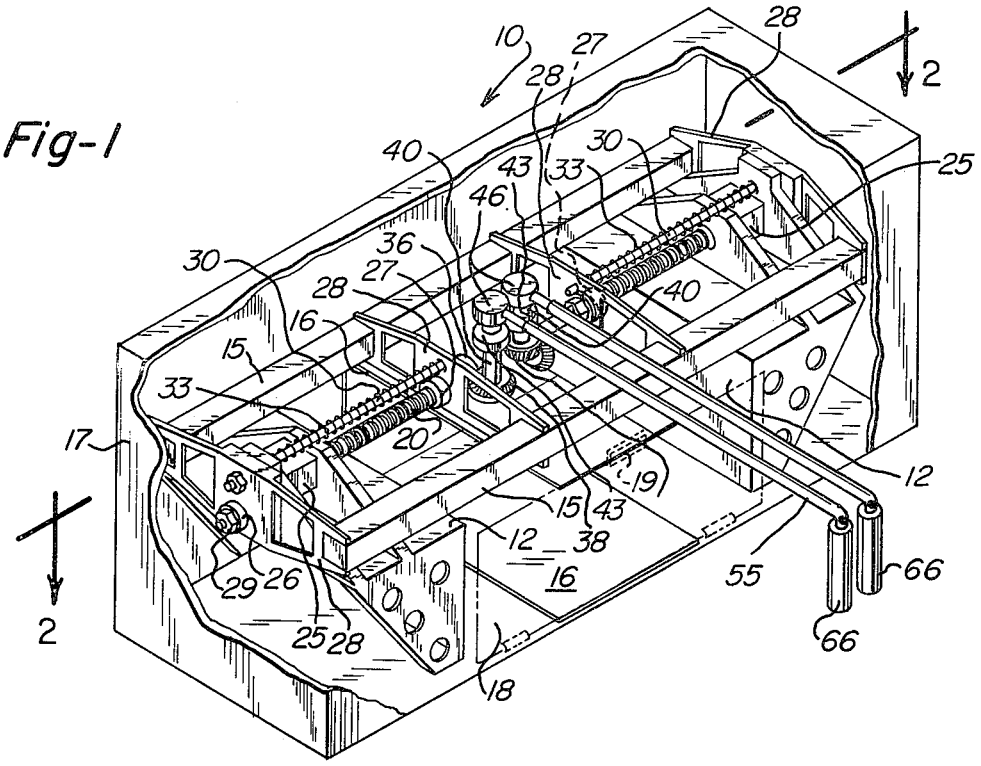
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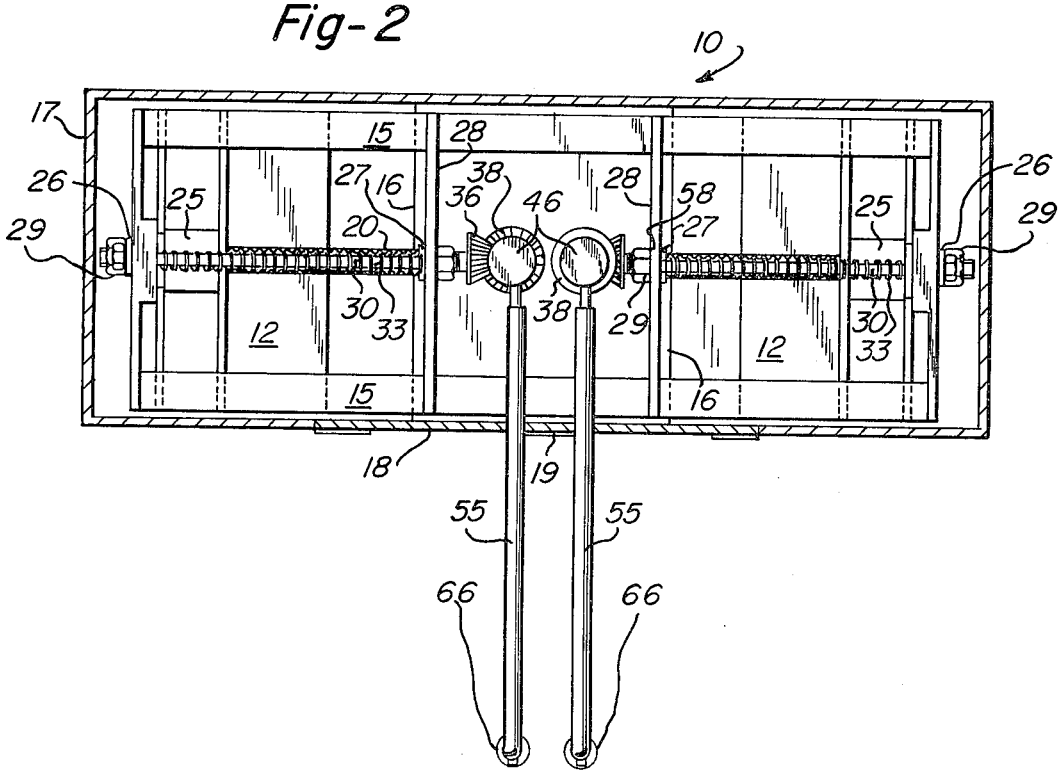
Fig-2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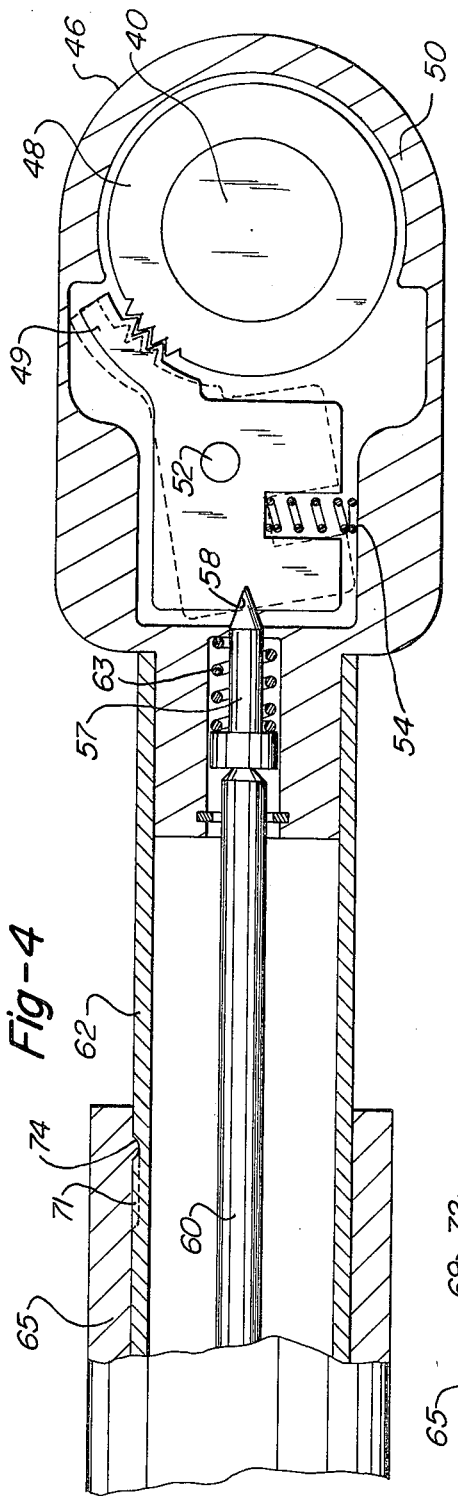
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Fig-4

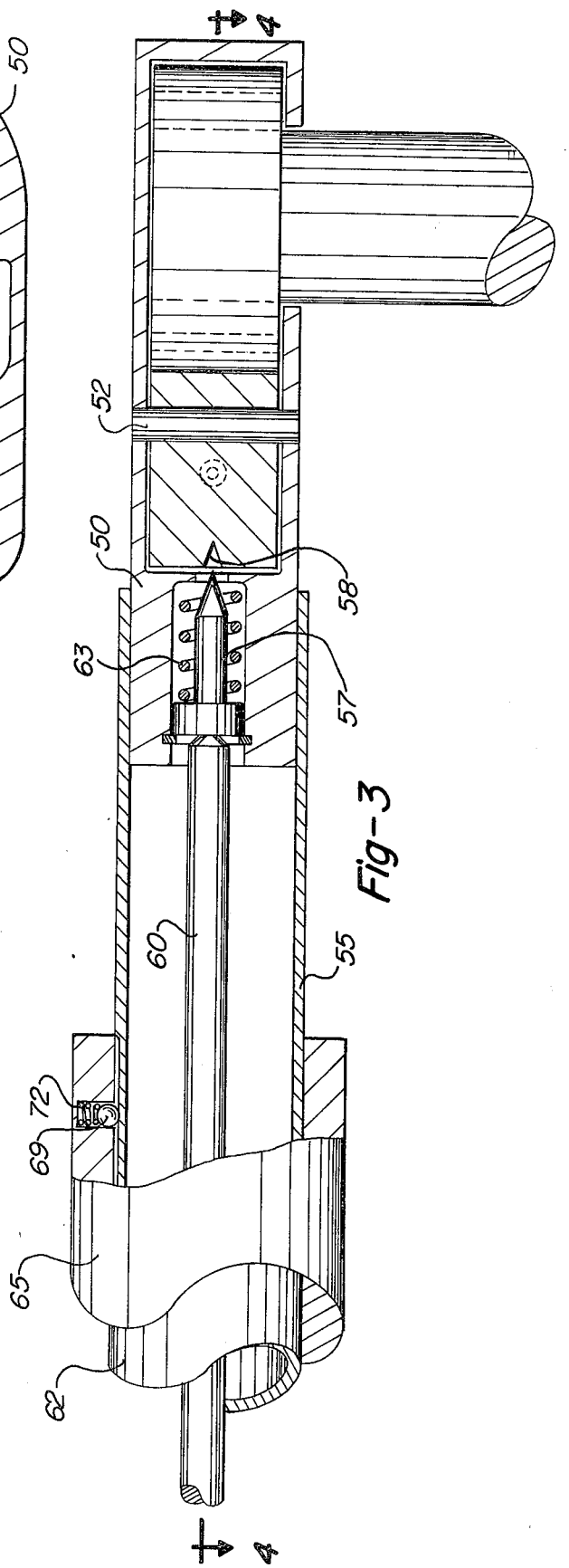
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Fig-3

MANUAL COMPACTOR

BACKGROUND OF THE INVENTION

The invention described herein was made in performance of work under NASA Contract Number NAS 9-14686 and is subject to the provisions of Section 305 of the National Aeronautics and Space Act of 1958 (72 Stat 435; 42 U.S.C. 2457).

FIELD OF THE INVENTION

The present invention relates generally to manual compacting devices, and more particularly to an improved and particularly advantageous apparatus for conversion of manually generated opposing rotational force to linear force and the application of such force to material to be compacted.

DESCRIPTION OF THE PRIOR ART

Compacting devices, by reason of their value in situations as diverse and varied as reducing the volume of trash and garbage, extracting juices from fruits and vegetables, and converting crops such as cotton and hay into easily managed bales, have been known and used for some time. Various arrangements have been suggested, most employing mechanical advantage achieved by use of the screw and nut principle whereby lienear force is generated through application of rotary motion to the screw. Descriptions of the basic screw operated press are contained in U.S. Pat. No. 304,594, issued Sept. 2, 1884, and U.S. Pat. No. 547,041, issued Oct. 1, 1895. Certain details in these patents are, in fact, common to most subsequent devices for the application of compacting force, most notably the ratchet and pawl arrangement through which the screw is operated. U.S. Pat. No. 614,804, issued Nov. 22, 1893, concerns a device for the purpose of allowing the ratchet operation of screws in either direction, such that the screw may be fully rotated while the ratchet handle is moved back and forth through an arc less than a full revolution.

Although previously suggested means for the application of compacting force work well in some circumstances, most require solid mountings and heavyweight castings and members to opposite forces generated during operation. The input forces through a lever, wheel or other such mechanism are conventionally counteracted by the mass or mounting of the compactor device. The need for strength in the apparatus often makes portability an impossibility.

SUMMARY OF THE INVENTION

The present invention, which provides a heretofore unavailable improvement over previous manual compactors, comprises a compactor in which operating forces are applied through leverlike handles connected by ratchet means to bevel gears which in turn transmit the force through ball screws and ball screw nuts to pressure plates. Because the operating handles move inwardly, toward one another, on the compacting stroke, applied forces are substantially balanced and the need for fixed mounting of the apparatus and heavyweight construction is significantly decreased. Anti-slip support or light clamping suffice to offset uneven application of force through the handles.

Accordingly, an object of the present invention is to provide a new and improved means for the application of compacting force between moving pressure plates wherein manual movement of handles is translated from rotary motion to linear motion by action of ball screws and ball screw nuts.

Another object of the present invention is to provide a new and improved structure for the application of compacting force generated by manual means wherein construction of the apparatus, by reason of the counteraction of forces involved, may be lightweight and portable.

Yet another object of the present invention is to provide a new and improved structure for manual compacting of diverse materials in which the application of operating force does not have the effect of causing the apparatus to move about in its entirely due to substantial unbalanced forces, thereby allowing the apparatus to be of lightweight construction and operable without permanent mounting to a work surface.

These and other objects and features of the present invention will become apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. **1** is a front perspective view of a manual compactor according to the instant invention, with portions of the enclosure cut away to reveal construction;

FIG. **2** is a top, sectional view along line **2—2** of the manual compactor of FIG. **1**;

FIG. **3** is a partially sectioned top view of the ratchet assembly and handle member; and

FIG. **4** is a partially sectioned side view of the ratchet assembly and handle member.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to the drawings, wherein like components are designated by like reference numerals throughout the various figures, a manual compactor according to the instant invention is shown in FIGS. **1** and **2** and designated by reference numeral **10**. Manual compactor **10** is primarily formed of, preferably, a lightweight metallic alloy such as aluminum.

As illustrated, compactor **10** is comprised of pressure plates **12**, fabricated preferably in buttressed form so as to be capable of transmitting force sufficient for compacting, and slidably bearing against support structure **15** for linear movement toward or away from one another. Containment member **16** is positioned to receive pressure plate **12** at the portions of travel thereof which generated the greatest compacting pressures. Pressure plates **12** and support structure **15** are totally within enclosure **17**, which is preferably formed of a suitable lightweight sheet metal (plastic or other such material), with the space directly between the compression faces reachable through hinged access door **18**, fitted with a suitable latch **19**. Access door **18** is of reinforced construction and cooperates with containment member **16** to provide a defined, structurally strong volume configured to receive pressure plate **12**. The area in which compacting force is applied is thus defined by containment member **16** at the top, bottom and back, access door **18** in front, and pressure plates **12** at either end.

Linear compacting movement of pressure plates **12** is effected by the low friction action of conventional ball screw nuts **25**. Mechanical action in this portion of the device is effectively the same for both left and right sides and therefore will be described only once. Ball screw nuts **25** are positioned at and secured by the

upper structure of pressure plates **12** such that the transfer of linear motion is parallel with the longitudinal axis of ball screws **20**, and directly to pressure plates **12**. Screws **20** are positioned within enclosure **17** by suitable bearings **26** and **27** fixed to crossmembers **28** of support structure **15**.

Screws **20** are free to rotate within the bearings **26** and **27** while being held in position laterally by locknuts. By reason of the mechanical action of the screw thread against ball screw nut **25**, as shown in detail in FIG. **3**, rotational movement of screws **20** is converted to linear motion of ball screw nuts **25** and thence to pressure plates **12**. Guide rods **30**, oriented with major axes parallel to the major axes of screws **20** and firmly fixed to crossmembers **28** of support structures **15**, align with and pass through suitably positioned holes in the upper portion of pressure plates **12** and serve to maintain pressure plates **12** in alignment with respect to one another and, in conjunction with screws **20** define the path of travel of pressure plates **12**. Compression springs **33**, fitted over guide rods **30**, serve to apply retractional force to pressure plates **12**; that is, extension of springs **33** tends to cause plates **12** to move away from each other thereby repositioning plates **12** for the insertion of additional material therebetween.

Rotational motion of screws **20**, and therefore eventual linear compressional movement of pressure plates **12**, is a result of rotational input to screws **20** through bevel gears **36**. The single exception to the mirror image mechanical operation of compactor **10** occurs in this gear power transmission section. Bevel gears **36** mesh with bevel gears **38** which, as a result of features to be described below, rotate in opposite directions. In order to impart this counterdirectional motion to screws **20**, thereby effecting opposing linear motion to pressure plates **12** through ball nuts **25**, bevel gears **36** and **38** on one side of compactor **10** are set to mesh below the center line of screw **20** while bevel gears **36** and **38** on the opposite side are aligned to mesh at a point above the center line of the screw **20**. Counter-rotational movement is thereby conserved and translated into opposing linear movement of pressure plates **12**.

Bevel gears **38** are journalled on shafts **40**, turning within bearings **43** fixed to enclosure **17**. The upper ends of shafts **40** terminate in ratchet assemblies **46**, as shown in FIGS. **3** and **4**.

Ratchet assemblies **46**, being mirror images of one another, are comprised of ratchet gears **48**, firmly fixed to shafts **40** at their upper ends, and pawls **49** positioned as to act upon gears **48**, causing them to revolve. Pawls **49** are enclosed in housings **50**, positions to freely revolve about ratchet gearts **48**. Pawls **49** are pivotally mounted on shafts **52**, journalled in housings **50** such that their major axes are parallel with the major axes of ratchet gears **48** and shafts **40**. Pawls are normally held in engagement with ratchet gears **48** by action of spring **54**, which cause pawls **49** to rotate about shafts **52**. With pawls **49** in the meshed position with ratchet gears **48**, lateral force applied in one direction to the handles **55** of the ratchet assemblies **46** is carried through pawls **49** and gears **48** to produce rotational movement of shaft **40**. Movement of handles **55** in a direction opposite to the operating direction results in disengagement of the pawls **49** from the ratchet gears **48** by reason of the positioning of pivot shafts **52** and the compression of spring **54**.

Means for totally disengaging pawls **49** from gears **48** in order to facilitate unhindered movement of pressure plates **12** is made possible by the action of release pin **57** on pawls **49**. Release pin **57**, having a conical point at one end and slidably mounted within housing **50**, is located so as to contact and fit within a suitably shaped depression **58** in pawl **49** when linear force is applied to pin **57** urging it generally toward the center of gear **48**. By reason of the location of pivot shafts **52** in relation to depression **58**, movement of the release pin **57** into depression **58** and subsequent applied force translates to rotational force and causes pawls **49** to rotate about shafts **52** and disengage from gear **48**.

The linear force which urges pins **57** toward the center of gears **48** to effect disengagement of pawls **49** from gears **48** is supplied to the pin through push rods **60**, located substantially concentrically within inside handle members **62**, which are preferably of tubular form. Push rods **60** are free to move linearly within handle members **62** and positioned to engage release pins **57** and displace pins **57** toward gears **48** for engagement at depressions **58** and rotation of pawls **49** out of engagement with gears **48**. Release pins **57** are held in a normal retracted position by compression springs **63** until acted upon by push rods **60**.

Actuation of push rods **60** within housings **62** is accomplished through the attachment of rods **60**, at their ends opposite the ends in contact with release pins **57**, to outer handle members **65**. Outer handle members **65**, preferably having grasping portion **66** bent at a suitable angle for manual operation, are formed of tubular material and have an inside diameter suitable for engagement in telescope fashion, of inner handle members **62**. Outer handle members **65** are capable of assuming two positions: i.e., extension during compacting operation of the compactor ratchet and pawl drive system thus offering maximum leverage for application to pawls **49** and allowing release pin **57** to remain retracted by reason of force applied to it by compression springs **63**; and retraction during retraction of pressure plates **12** at the completion of the compacting operation, thereby causing push rods **60**, attached to handle members **65**, to move into contact with release pins **57** and urge the pins into depressions **58** in pawls **49**, causing rotation of pawls **49** about pivot shafts **52** and subsequent disengagement of pawls **49** with gears **48** and thereby allowing retractional movement of pressure plates **12**. In the preferred embodiment handle members **65** are positively located in either extended or retracted position by ball detents **69**, shown at inward position in FIG. **3**, which are urged into firm contact with raceways **71** on inner handle members **62** by compression springs **72**. Raceway **71** is formed so as to provide suitable depressions **74** to define maximum travel of member **65** and to hold member **65** firmly in either fully retracted or fully extended position. Similar arrangements (not shown) are provided at the extended position of handles **65**.

In operation, after material to be compacted is placed inside enclosure **17**, and preferably within a reinforced bag within enclosure **17**, manual force is applied to the compactor via extended and locked members **65**. Movement of handle members **65** through an arc toward each other is translated, by means of pawls **49** and ratchet gears **48** into rotary motion of shafts **40**. The resultant force is carried by shafts **40**, on which ratchet gears are journalled. Bevel gears **38**, fixed on shaft **40** and meshed with bevel gears **36**, fixed upon the ends of screws **20**, transfer the rotary motion to the screws **20**, thus causing screws **20** to generate linear force at ball screw nuts **25**. Linear movement of ball screw nuts **25** urges pressure

plates **12**, firmly connected to ball screw nuts **25**, to move toward each other, thereby generating compacting pressure between the plates and inside enclosure **17**.

Following the application of manual force on handle members **65** and the movement of the handles together, a counter force on the handle causes pawls **49** to rotate about shafts **52**, compress springs **54**, and disengage from ratchet gears **48**. This disenagement allows handle member **65** to be manually returned to the position for application of additional force. Subsequent inward pressure upon handle members **65** causes pawls **49** to rotate in the opposite direction about shafts **52** and engage once again ratchet gears **48**, allowing the manual input movement again to be translated to compacting force on pressure plates **12**.

When sufficient force has been applied through the ratchet operation of handle members **65** to compact the material placed within enclosure **17**, handle members **65** are slidably moved along inner handle members **62** toward ratchet assemblies **46**, thereby causing connected pushrods **60** to contact and urge inward release pins **57**. Release pins **57** then engage pawls **49** at depressions **58**, causing the pawls to rotate about shafts **52** and disengage from ratchet gears **48**. Disengagement of pawls **49** from ratchet gears **48** allows free rotation of screws **20** and, subsequently, free linear motion of pressure plates **12**. Linear force then applied to the pressure plates by compression springs **33**, fitted over guide rods **30**, causes plates **12** to move away from each other, readying the area between them for yet another cycle of compacting.

Although only preferred embodiments of the present invention have been illustrated and described, it is anticipated that numerous changes and modifications will be apparent to those skilled in the art, and that such changes may be made without departing from the scope of the invention as defined by the following claims.

What is claimed is:

1. A manual compactor comprising;
an enclosure having a door defined therein;
an elongated support structure positioned within the enclosure;
a pair of pressure plates having face portions, the pressure plates being slidably mounted for reciprocal movement relative to support structure with the face portions opposing one another;
a pair of screw members rotatably mounted to the support structure with one screw member adjacent each pressure plate;
a pair of nut members secured one each to each pressure plate and each engaging a screw member;
a pair of elongated handles rotatably mounted adjacent one another; and
ratchet means and drive means connecting the handle members through the drive means to the screw members, the screw members, nut members, ratchet means and elongated handles being arranged to move the pressure plates together when the handles are moved with opposite rotational sense;
whereby the rotation of the handle members rotates the screw members through the drive means and moves the pressure plates forcefully together.

2. A manual compactor as set forth in claim **1** in which the nut members are ball nuts having therein ball rollers configures to engage the screw members.

3. A manual compactor as set forth in claim **2** in which return springs are positioned between each pressure plate and the support structure to bias the pressure plate to a spaced apart relationship.

4. A manual compactor as set forth in claim **3** in which the ratchet means include ratchet release means to disengage the ratchet means thereby alowing the return springs to position the pressure plates in a spaced apart relationship.

5. A manual compactor as set forth in claim **1** which includes a reinforement member positioned within the inclosure adjacent the door thereof and extending around the enclosure at the bottom, side opposite the door, and upper portions, the reinforcement member being a three sided structure of sufficient dimension to permit the face portions of the pressure plates to move therein.

6. A manual compactor comprising;
an enclosure having a door defined therein;
an elongated support structure positioned within the enclosure;
a pair of pressure plates slidably mounted for reciprocal movement relative to the support structure and having face portions arranged in opposing relationship;
a pair of compression springs positioned one each between each of the pressure plates and support structure;
a pair of screw members rotatably mounted to the support structure and positined one each adjacent each of the pressure plates;
a pair of ball nut members attached one each to each of the pressure plates and engaged with each ball screw member engaging the screw member adjacent each corresponding pressure plate;
a pair of ratchet means each having a release means therein;
a pair of elongated handles attached one each to each ratchet means;
drive means connecting the ratchet means to screw members; and
a reinforcement member positioned within the enclosure adjacent the door, the reinforcement member being a three sided structure extending adjacent the path of travel of the pressure plate at the bottom, side opposite the door and upper portion of such path of travel.

7. A manual compactor as set forth in claim **6** in which a pair of guide rods are included in the support structure and connected thereto, and each pressure plate is slidably mounted on a guide rod with said compression springs also positioned one each on each guide rod between the pressure plate and the support structure.

8. A manual compactor as set forth in claim **7** including telescoping handles operably connected to the ratchet means to release the ratchet means upon telescoping of the handles.

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